The Coastal Ocean Processes (CoOP) Planning and Management

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LONG-TERM GOALS

The goal of CoOP is to advance our quantitative understanding of the processes and interactions among the processes that determine the characteristics of coastal systems including the cross-shelf transports, transformations and fates of biologically, chemically and geologically important materials. The CoOP Program implements multi-investigator, interdisciplinary research in the coastal ocean, which encompasses the disciplines of Biological, Chemical, Geological and Physical Oceanography and Marine Meteorology.

OBJECTIVES

CoOP's underlying scientific planning assumption is that a series of well designed, interdisciplinary process studies at locations that are characterized by different combinations of fundamental transport processes will provide significant new information to advance our understanding of coastal oceans and be applicable to continental margins around the world. Coupled interdisciplinary process studies and modeling are the core of CoOP research programs. The specific objectives of this project are to facilitate coordination and communications amongst the CoOP research projects; to inform the coastal oceanographic community about relevant coastal research progress and opportunities; and to direct the strategic planning activities for future CoOP research initiatives.

APPROACH

The CoOP Office maintains a website (http://www.skio.peachnet.edu/coop/) and publishes and distributes newsletters as needed to approximately 1700 coastal scientists to inform the coastal community of research in progress or planned. The newsletters include brief research articles for at least two CoOP projects in each issue. All newsletters published by the current Office are available on the website. The Office also publishes and distributes reports resulting from CoOP workshops. The most recent report is available on the CoOP website.

The CoOP research plan is to conduct process and modeling studies on coastal margins, which differ in the dominant physical transport processes. CoOP studies thus attempt to isolate key processes that have some global generality and to study these in detail on margins where effects can be isolated with a maximum degree of confidence. The Office works to facilitate the infusion of emerging technologies, such as coastal observatories, into these observational programs to maximize their

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14. ABSTRACT
The goal of CoOP is to advance our quantitative understanding of the processes and interactions among the processes that determine the characteristics of coastal systems including the cross-shelf transports, transformations and fates of biologically, chemically and geologically important materials. The CoOP Program implements multi-investigator, interdisciplinary research in the coastal ocean, which encompasses the disciplines of Biological, Chemical, Geological and Physical Oceanography and Marine Meteorology.

15. SUBJECT TERMS

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impacts. Modeling studies are integrated with the process studies and used to synthesize and generalize study results. CoOP initially proposed in the early 1990s to study five general categories of cross-shelf transport: wind-driven, tidally-driven, buoyancy-driven and western boundary current-driven transport and transport on seasonally ice-covered shelves. With improving sensor technology and the recognition of the importance of long-time series studies, facilitating the development of coastal observatories is a CoOP focus in the near term.

PROJECTS BEGINNING OR CURRENTLY UNDERWAY

Buoyancy-driven Transport: Two new CoOP Projects were funded by NSF in early 2003 to study cross-shelf transport processes affected by buoyancy and freshwater input.

RISE - River Influences on Shelf Ecosystems - RISE focuses on the highly productive eastern boundary plume of the Columbia River - a plume large enough to be of regional importance but small enough to allow determination of dominant processes. RISE will examine three hypotheses: 1) during upwelling the growth rate of phytoplankton within the plume exceeds that in nearby areas outside the plume being fueled by the same upwelling nitrate; 2) the plume enhances cross-margin transport of plankton and nutrients; and 3) plume-specific nutrients Fe and Si enhance productivity on nearby shelves. RISE funds 12 PIs from the University of Washington, Oregon State University, Oregon Graduate Institute, Scripps Institution of Oceanography, and University of California Santa Cruz.

LATTE - Lagrangian Transport and Transformation Experiment - Using coordinated field and numerical experiments; LATTE will examine the processes controlling the transport and fate of nutrients and chemical contaminants in the Hudson River plume. The plume emanates from one of the nation's most urban estuaries - the New York/New Jersey Harbor complex. Towed-vehicle studies will take place within the framework of an operational ocean observatory so that physical processes which transport/mix material in a buoyant plume can be differentiated from biological and chemical transformation processes. LATTE funds 11 PIs from Rutgers, Lamont Doherty Earth Observatory, University of Massachusetts Boston, CalPoly, FERI and University of Florida Gainesville.

Wind-driven Transport: Two research projects along the Oregon and California coasts initiated in 2000 to examine margin processes in locations where wind transport is a dominant factor have now completed their field years and are entering the synthesis phase. The Coastal Advances in Shelf Transport (COAST) Project supports 18 PIs and is studying biogeochemical cycling at two locations on the Oregon coast that differ significantly in bottom topography. The Wind Events in Shelf Transport (WEST) Project supports 11 PIs and is focused on the relationship between wind-driven upwelling strength and biological productivity on the Northern California Shelf. The two projects have organized a joint special session for the AGU meeting in Portland in January 2004.

Drs. Jody Klymak and Jim Moum have recently submitted a paper to Geophysical Research Letters of realizations of bottom solitons as measured during the COAST January-February 2003 field experiment. They have generously supplied examples of their observations, displayed in Figures 1 and 2.

Episodic Transport: Two studies of episodic, cross-margin transport events in the Great Lakes were initiated in 1997/98 and funding was complete at the end of 2002. The Keweenaw Interdisciplinary Transport in Superior (KITES) Project involved 16 PIs while the Episodic Events- Great Lakes Experiment (EEGLE) Project included 30 PIs. The KITES Project examined the exchange across the

strong coastal current that forms along the Keweenaw Peninsula during the spring transition while the EEGLE Project studied transport associated with spring-time wind events in Lake Michigan. The two

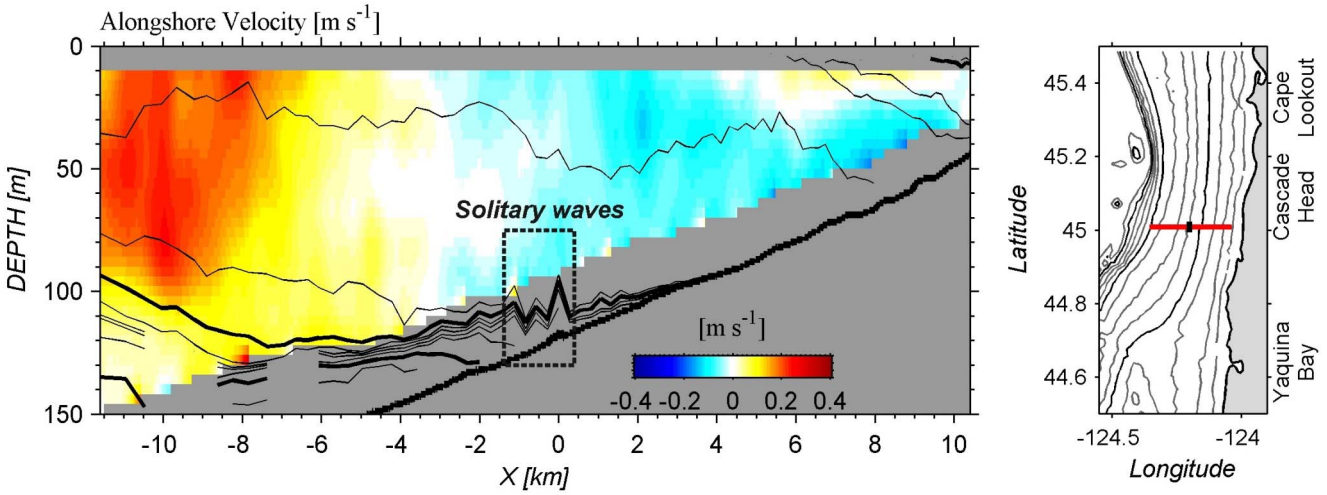

Fig. 1: Study site where near-bottom solitary waves were found during January 2003 cruise. Data was collected aboard the R/V Revelle by the OSU Ocean Mixing Group (James Moum). Shown is a section of potential density and north-south velocity across the Oregon shelf at 45 N, beginning at the west end on 1645 28 January 2003 and ending at 0049 29 January (UT). Contour lines of isopycnals are drawn in intervals of 0.2 kg/m^3; 26 and 25 kg/m^3 are drawn thicker. The colored image represents ADCP velocities. The area of interest is within the dashed box near 0 km (124.20 W). A local map is shown at right with the occupied transect as a red line off Cascade Head. The winds were recently down-welling favorable (southerly), but had reversed a day before this section to up-welling favorable.

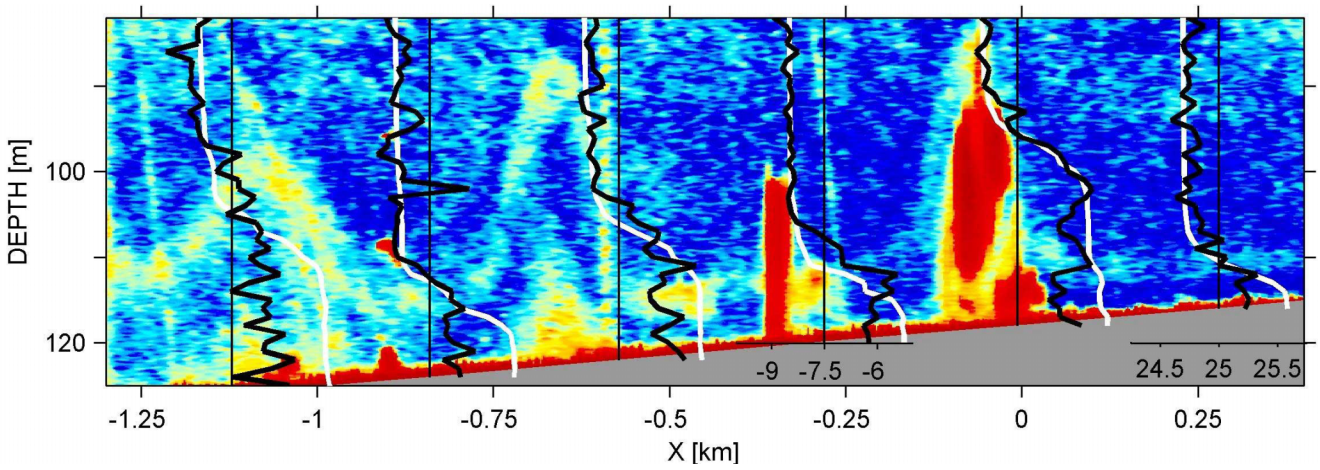

Fig. 2: Detail of internal solitary waves of elevation on the seafloor. The 120 kHz echo-sounder image scatters from biology and shows the outline of 30 m tall waves. Profiles with the Ocean Mixing Group's turbulence profiler Chameleon indicate that the waves are along a sharp density interface near the bottom and that the region below the interface is very turbulent. Their proximity to the bottom means that they have significant near bottom stresses that will enhance sediment suspension. Other data indicate that these waves are propagating onshore with a velocity estimated to be approximately 0.5 m/s. A numerical fit to the data indicates that the lead wave may have a recirculating core that is transporting fluid from offshore, and possibly trapping biology consistent with the cloud of scatterers in the echo-sounder image.

projects organized a joint special session at the Ocean Sciences meeting in Honolulu in February 2002. A special issue of *the Journal of Geophysical Research* is underway, with 22 manuscripts submitted and currently in review from both projects. A special issue of *the Journal of Great Lakes Research* is also planned, as well as a synthesis volume which will be published in the AGU monograph series.

FUTURE EFFORTS

Planning for Coastal Observatories

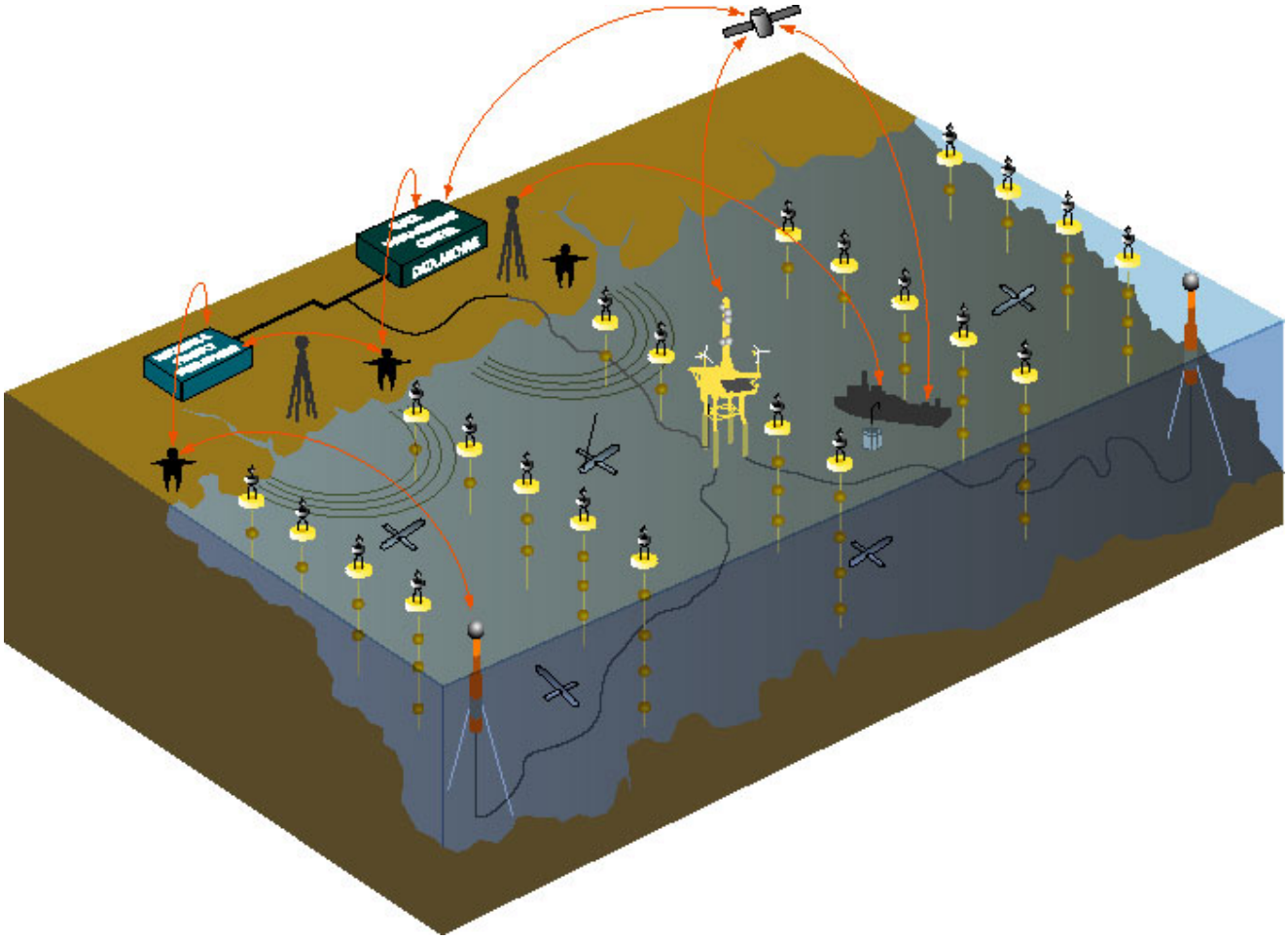

Figure 3. Artist's rendition of a Pioneer Array, a coastal research observatory array with relocatable, moored, and cabled components. Possible design elements include remote sensors such as HF radar, airplane and satellite sensors; fixed sensors located on towers, moorings and other platforms; and mobile sensors including ship-based, glider and AUV-mounted sensors. Arrows indicate two-way communications among sensors, observatory scientists and operators, and other end-user populations.

Coastal ocean observatories represent a fundamentally new enabling technology that will permit future research efforts to examine processes on space and time scales not previously achievable. This includes sustained measurements at multiple locations to develop synoptic time-series observations of large-scale phenomena and sustained high frequency measurements to examine short-duration and rare events. Real-time data reporting also greatly expands research opportunities by supporting remotely-controlled and targeted sampling efforts. The technological capabilities afforded by coastal, cabled observatories such as high bandwidth, two-way communication and substantial power for measurement systems will provide unprecedented access to the sea and enhance scientific inquiry by providing continuous, long-term measurements of oceanographic and atmospheric quantities. The development of critical technologies in communications, power, robotics, and ocean engineering will

facilitate infrastructural changes that will gradually rival and in some instances displace ships as the main observational platforms for studying ocean processes. Additionally, the data management framework, which is envisioned to unite the national C-IOOS backbone, will greatly facilitate and expand coastal research efforts.

The report from the CoOP Coastal Observatory Science workshop in May 2002 was published in November 2002 (Jahnke et al. 2002). The 2.5 day workshop included an assessment and prioritization of coastal research issues; a review of existing observatory systems; development of a list of critical hypotheses, questions and processes; consideration of the necessary attributes of coastal ocean observatories; and recommendations for the optimum way to implement coastal ocean observatories. A significant workshop accomplishment was the development of the concept of a Pioneer Array, so designated because the array is intended as a test bed for new instrumentation groundtruthing and to function as a progenitor for the establishment of longer-term coastal observation systems (Fig. 3).

Recognizing the local complexity and regional variability of coastal processes, the initial array design emphasized the need for a significant number of individual measuring/mooring points within an array and the capability of relocating the array to other areas. The initial vision also called for a 'legacy' component which could be left in place to provide a longer time-series record. This long-term component could be a relatively simple mooring or a more complex cabled observation node. Thus, the Pioneer Array can be thought of as a coastal research array that can be scalable spatially (by adjusting the number, density and areal extent of mooring/measurement locations) and temporally (by combinations of telemetered and high-bandwidth cable-transmitted data streams).

Further definition and validation of the Pioneer Array concept will occur in November 2003, when a small group of CoOP SSC members and other invitees will meet for an intensive 2-day workshop. It is intended that this meeting will produce design templates for coastal observatories in advance of the ORION workshop in January 2004. Development of the array design is also important for the success of the next CoOP initiative, benthic boundary layer exchange. An open workshop is planned in early April 2004, at the USGS facility in St. Petersburg, FL, to develop the science plan for an NSF announcement of opportunity on benthic exchange anticipated in 2005.

REFERENCES

Jahnke, R., L. Atkinson, J. Barth, F. Chavez, K. Daly, J. Edson, P. Franks, J. O'Donnell and O. Schofield (2002) Coastal Ocean Processes and Observatories: Advancing Coastal Research. Coastal Ocean Processes (CoOP) Report No. 8, November 2002. Skidaway Institute of Oceanography Technical Report, SkIO TR-02-01, 51 pp.

Klymak, J. M. and J. N. Moum (2003) Internal solitary waves of elevation advancing on a shoaling shelf. Geophys. Res. Lett., submitted.

PUBLICATIONS

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